We claim:

1. A method for measuring the aberrations of a negative lens, comprising:

producing a diverging measurement wavefront of light from a first diffracting aperture;

positioning a negative lens under test in said diverging measurement wavefront such that said negative lens modifies and substantially transmits said diverging measurement wavefront to produce a first diverging measurement wavefront;

introducing an aperture stop at said negative lens under test;

converting said first diverging measurement wavefront from a diverging to a converging wavefront with an auxiliary optical element to produce a first converging measurement wavefront;

producing a diverging reference wavefront from a second diffracting aperture and phase shifted relative to said diverging measurement wavefront;

propagating a portion of said reference wavefront onto a detector;

reflecting said first converging measurement wavefront from surface of said second diffracting aperture onto said detector, wherein said reference wavefront and said first converging measurement wavefront combine to form a first interference pattern on said detector;

removing said negative lens from said aperture stop;

re-positioning said first diffracting aperture relative to said auxiliary optical element such that said diverging measurement wavefront converges therefrom to produce a second converging measurement wavefront; and

reflecting said second converging measurement wavefront from surface of said second diffracting aperture onto said detector, wherein said reference wavefront and said converging second measurement wavefront combine to form a second interference pattern on said detector.

2. The method of claim 1, wherein either or both of said first diffracting aperture and said second diffracting aperture comprise a planar diffracting aperture selected from a group consisting of a single mode fiber optic and a pinhole in a reflective substrate.

3. The method of claim 2, wherein said single mode fiber optic comprises an output end having a reflecting layer.

4. The method of claim 1, further comprising introducing an imaging lens for imaging said aperture stop onto said detector.

5. The method of claim 1, wherein said optical element is selected from a group consisting of a positive lens and a concave mirror.

6. The method of claim 1, wherein said detector comprises a CCD camera.

7. The method of claim 1, further comprising analyzing said first interference pattern to determine a first calculated wavefront comprising the sum of the aberrations of said negative lens and errors due to a single transmission through said auxiliary optical element and further comprising analyzing said second interference pattern to determine a second calculated wavefront due to a single transmission through said auxiliary optical element alone.

8. The method of claim 7, further comprising obtaining aberrations of said negative lens by subtracting said second calculated wavefront from said first calculated wavefront.

9. An apparatus for measuring the aberrations of a negative lens, comprising:

means for producing a diverging measurement wavefront of light from a first diffracting aperture;

wherein a negative lens under test positioned in said diverging measurement wavefront will modify and substantially transmit said diverging measurement wavefront to produce a first diverging measurement wavefront;

an aperture stop positioned at said negative lens under test;

an auxiliary optical element for converting said first diverging measurement wavefront from a diverging to a converging wavefront to produce a first converging measurement wavefront;

means for producing a diverging reference wavefront from a second diffracting aperture;

means for phase shifting said diverging reference wavefront relative to said diverging measurement wavefront;

a detector positioned within the path of a portion of said reference wavefront;

means for reflecting said first converging measurement wavefront from the surface of said second diffracting aperture onto said detector, wherein said reference wavefront and said first converging measurement wavefront combine to form a first interference pattern on said detector;

wherein the removal of said negative lens from said aperture stop and the re-positioning of said first diffracting aperture relative to said auxiliary optical element will cause said diverging measurement wavefront to converge from said first diffracting aperture relative to produce a second converging measurement wavefront; and

means for reflecting said second converging measurement wavefront from surface of said second diffracting aperture onto said detector, wherein said reference wavefront and said converging second measurement wavefront combine to form a second interference pattern on said detector.

10. The apparatus of claim 9, wherein either or both of said first diffracting aperture and said second diffracting aperture comprise a planar diffracting aperture selected from a group consisting of a single mode fiber optic and a pinhole in a reflective substrate.

11. The apparatus of claim 10, wherein said single mode fiber optic comprises an output end having a reflecting layer.

12. The apparatus of claim 9, further comprising an imaging lens for imaging said aperture stop onto said detector.

13. The apparatus of claim 9, wherein said optical element is selected from a group consisting of a positive lens and a concave mirror.

14. The apparatus of claim 9, wherein said detector comprises a CCD camera.

15. The apparatus of claim 9, further comprising a computer readable memory including software for analyzing said first interference pattern to determine a first calculated wavefront comprising the sum of the aberrations of said negative lens and errors due to a single transmission through said auxiliary optical element and further comprising analyzing said second interference pattern to determine a second calculated wavefront due to a single transmission through said auxiliary optical element alone.

16. The apparatus of claim 15, further comprising a computer readable memory including software for obtaining aberrations of said negative lens by

subtracting said second calculated wavefront from said first calculated wavefront.

17. A method for measuring the aberrations in a convex mirror, comprising:

producing a first measurement wavefront of light diverging from a first diffracting aperture at a first position;

producing a first converging measurement wavefront from said first measurement wavefront;

introducing an aperture stop into said converging measurement wavefront;

reflecting said converging measurement wavefront from a second diffracting aperture onto a detector;

producing a first reference wavefront of light diverging from said second diffracting aperture and phase shifted with respect to said converging measurement wavefront, wherein a portion of said first reference wavefront propagates onto said detector and combines with said converging measurement wavefront to form a first interference pattern;

producing a second measurement wavefront and a second reference wavefront both diverging from said second diffracting aperture located at said

first position, wherein a portion of said second reference wavefront propagates onto said detector;

positioning a convex mirror under test at said aperture stop; and

converting said second measurement wavefront from a diverging wavefront to a converging wavefront to produce a converging second measurement wavefront that will reflect from said convex mirror under test to reverse its path and reflect from said second diffracting aperture to combine with said second reference wavefront to produce a second interference pattern.

18. The method of claim 17, wherein the step of producing said first converging measurement wavefront from said first measurement wavefront comprises introducing into said first measurement wavefront an auxiliary optical element selected from the group consisting of a positive lens and a concave mirror.

19. The method of claim 17, further comprising analyzing said first interference pattern to determine a first calculated wavefront due to a single transmission through said auxiliary optical element alone and further comprising analyzing said second interference pattern to determine a second calculated wavefront comprising the sum of the aberrations of said convex

mirror and errors due to two transmissions through said auxiliary optical element.

20. The method of claim 19, further comprising obtaining aberrations of said convex mirror by multiplying said first calculated wavefront by 2 and subtracting the result from said second calculated wavefront.

21. The method of claim 20, further comprising obtaining the surface shape of said convex mirror by dividing said aberrations of said convex mirror by 2.